BULLETIN

ENGINEERING DEPARTMENT

NATIONAL LAMP WORKS

OF GENERAL ELECTRIC CO.

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Bulletin 15 B

Lighting of Billboards and Large Painted Signs

Lighting of Billboards and Large Painted Signs

IN order that billboards or large painted signs may be illuminated to the best advantage, it is necessary that the light sources be concealed from the eye, that glare caused by the direct reflection of the lighting units from the painted surface be minimized, and that the illumination be fairly uniform and of an intensity high enough to cause the sign to stand out prominently. Glare may be avoided by mounting the units so that the light is thrown upon the sign from below, in which case, since the angle of incidence is equal to the angle of reflection, direct reflection cannot enter the eye of the observer unless he is looking down upon the sign from above. This arrangement is shown diagramatically in Fig. 1. If, as is sometimes the case, the sign is so located that the observer looks down upon it, it is evident that glare may be avoided by reversing the arrangement, that is, by lighting the sign from above. Such installations are applicable chiefly to signs which are so situated that highly concentrating reflectors of the automobile headlight type may be used to project the light from the roof or windows of a neighboring building upon the face of the sign, for if the units were mounted close to the sign in the usual manner, their supports would in most cases obstruct a view of the sign. Another method of mounting the units which overcomes a large part of the trouble from glare is to mount them well above the sign. If this is done, the observer will have to approach the sign closely before the glare is apparent. Fig. 2 shows that the higher the unit is mounted above the sign for a given distance in front of the sign the less will be the distance through which glare will be apparent. However, it will be noted from Fig. 3 that the higher the unit, the more concentrated the distribution must be to be effective; in this case, raising the reflector 4 feet reduces the effective zone from 68 degrees to 29 degrees. There is no moderate priced reflector for outdoor service at present manufactured which when mounted high above and close to the sign will satisfactorily illuminate it except at a very considerable sacrifice of efficiency. Obviously, were such reflectors to be had,

another difficulty would be experienced in spacing units so as to obtain a uniform distribution lengthwise of the board. White enamel is practically the only reflecting surface which will withstand severe weather conditions and the reflection from this surface is of too diffuse a character to permit the design of a

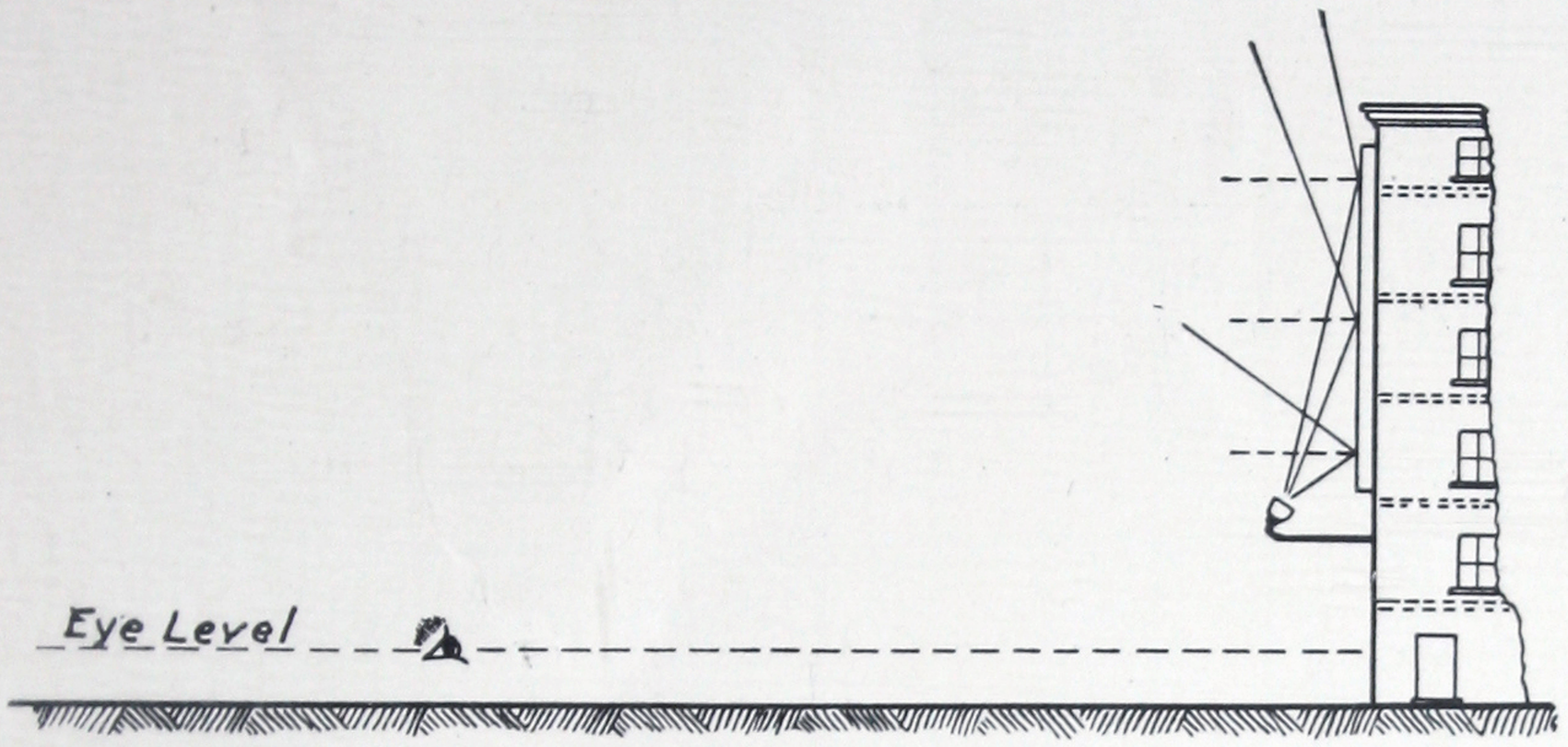

Fig. 1—Method of Avoiding Glare

reflector which will confine even a reasonable proportion of the light within such a restricted space. For this reason, it has been the usual practice to mount porcelain or paint enamel reflectors at the lowest point where they will not interfere with a view of the sign and either to disregard the effect of reflected glare entirely or

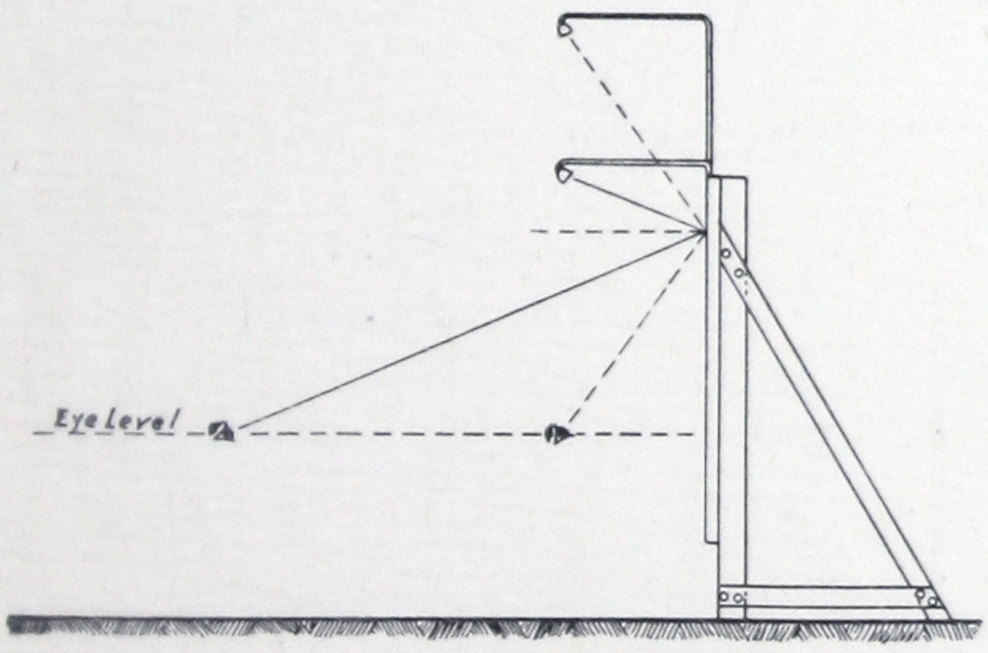

Fig. 2

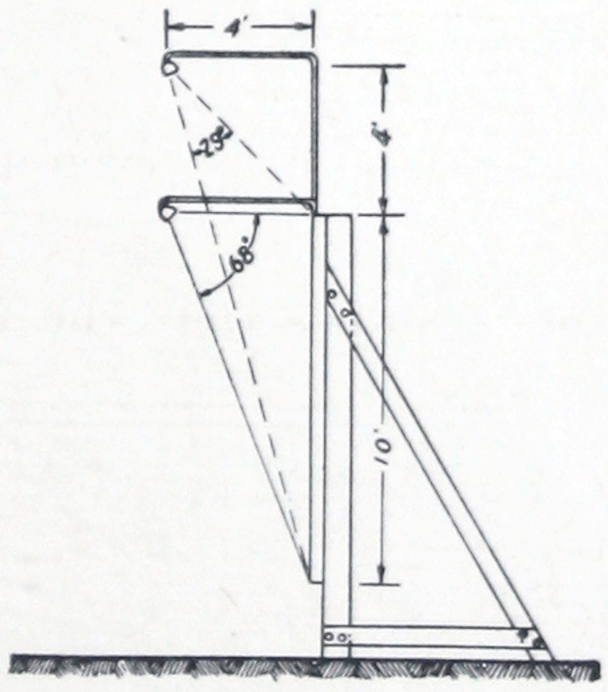

Fig. 3

The Higher the Unit is Mounted Above the Sign, for a Given Distance in Front of the Sign, the Less will be the Distance Through Which Glare will be Apparent; However, a Highly Concentrating Reflector Becomes Essential

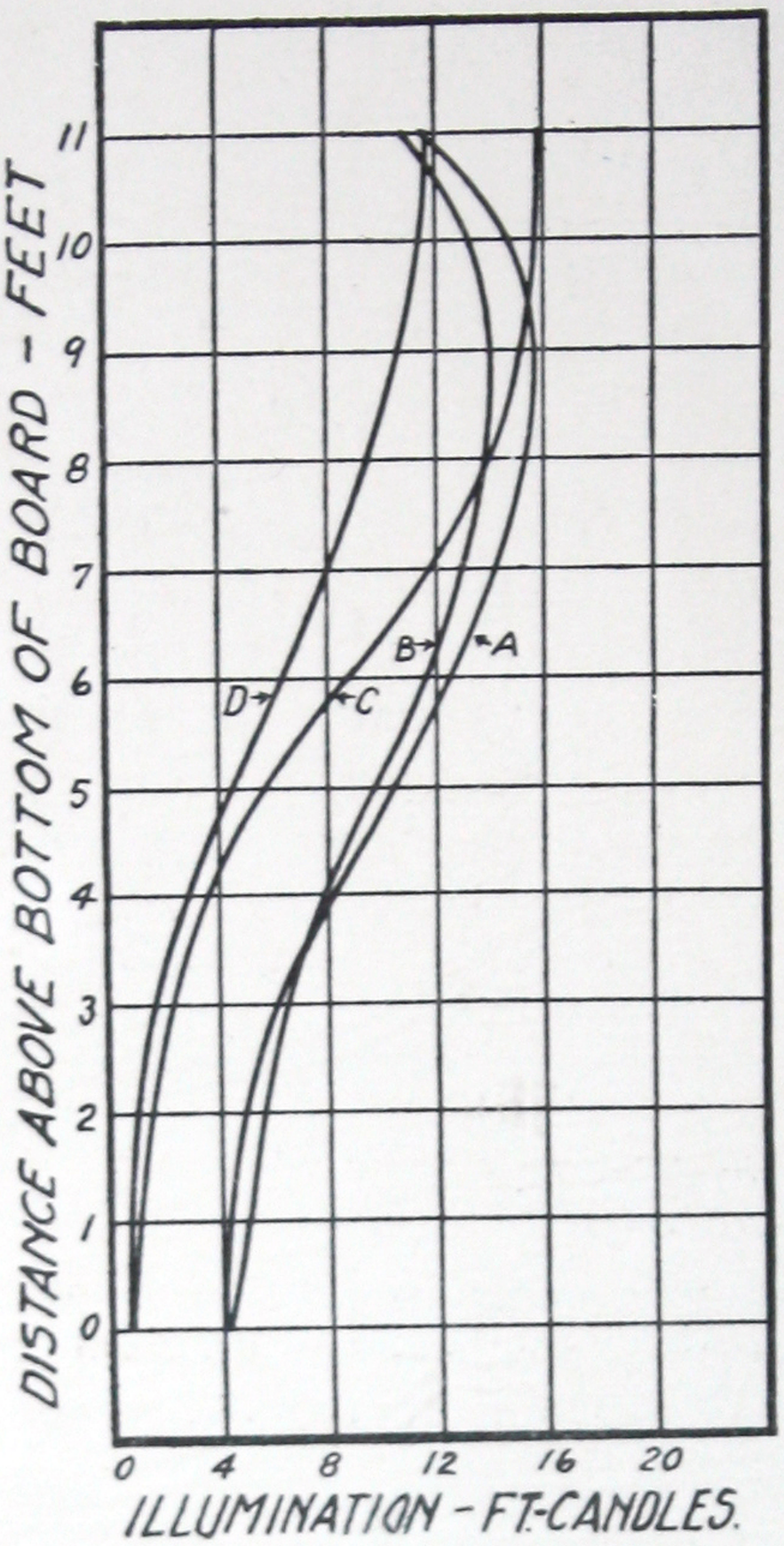

Fig. 4—Comparison of Light Distribution on an Eleven-Foot Board Obtained With Two Different Types of Units

A—Directly Beneath Units. Porcelain-Enameled Steel Angle Reflector.

B—Between Units. Porcelain-enameled Steel Angle Reflector.

C—Directly Beneath Units. Paint-Enameled, Trough-Shaped Reflector.

D—Between Units. Paint-Enameled, Trough-Shaped Reflector.

to minimize its bad effects by the use of a mat-surface paint on the sign.

With the present reflector equipment, the most practical illumination of billboards and large painted signs is accomplished by means of MAZDA lamps equipped with porcelain-enameled steel angle reflectors mounted in front of, and somewhat above, the top edge of the sign. Such reflectors if well designed waste little of the light above and below the sign; and direct the beam of maximum intensity toward the bottom of the sign, which is important not only because this part of the sign is farthest from the light source but also because of the acute angle at which the rays strike this part of the sign. They have also the decided advantage of being small in size and light in weight, which permits them to be hung far enough out from the sign to give uniformity of light distribution with little strain on the mechanical supports, and with a relatively small amount of shadow thrown upon the sign in the daytime. The porcelain-enameled surface is weatherproof, does not collect dirt easily, and is readily cleaned.

It is poor economy to sacrifice effective light distribution and efficiency for a small saving in the first cost of an installation. Uniform light distribution is of prime importance, for the value of a display lies in its attractiveness, and a decrease in uniformity

of the illumination means a decrease in the advertising value of the sign which is out of proportion to the small extra first cost of effective lighting. The curves of Fig. 4 show the difference in uniformity obtained with a common type of trough-shaped bulletin board reflector, and with a scientifically designed porcelain-enameled steel angle reflector. These curves represent the result of a test on an 11-foot board, in which the spacing distance between the units was, in both cases, 6 feet, the number of reflectors the same, and the rate of energy consumption 200 watts per unit in each installation. The ratio between the intensity of illumination at the foot of the board to that at the most brightly illuminated portion was 1 to 12.5 with the trough-shaped reflector, and 1 to 4 with the angle reflector. The close similarity between curves A and B indicates the even lateral distribution obtained with reflectors of the latter type. A careful analysis of the material and labor costs in the construction of the trough-shaped reflectors shows that their actual cost is not more than 30 per cent less than the price at which the more effective and durable steel angle type can be purchased.

The desirable intensity of illumination on a board depends, of course, upon the relative intensities of surrounding signs and upon the intensity of the general illumination of the locality. In Table 1 are given the lamps, reflectors, and mounting dimensions recom-

Table No. 1

Specifications for Sign Illumination

Height of Board, Feet	Size of Lamp, Watts	Mounting Dimensions			Average Illumination in Foot-Candles Obtained with Proper Porcelain-Enameled Steel Reflector
		Feet Out	Feet Apart	Feet Above Top	
3-5	60	4	6	1	9.0
6-8	100	5	6	½	9.0
9-12	100*	5½	5	½	7.0
9-12	200	6	6½	½	10.0
13-15	300	7	7	1	10.0
16-18	400	8½	8½	1½	10.0
19-21	500	10	10	2	10.0
22-27	400	8½†	8½	1½†	10.5
	750	15	13	3	10.0
28 up	500	10†	10	2†	10.5
	1000	18-21	16	3	9.0

* To be used where only moderate illumination is desired.
† One row of reflectors to be mounted in front and half-way between the top and bottom edges of the sign.

mended for the illumination of boards of various sizes. These data apply to usual conditions, that is, to boards situated in well lighted districts, with the exception that the unit marked with an asterisk should not be used on standard-sized boards, except in dark localities. In places where competing illumination is of an extraordinarily high intensity, the illumination on the board should be increased by substituting units of higher wattage than those specified in the table.

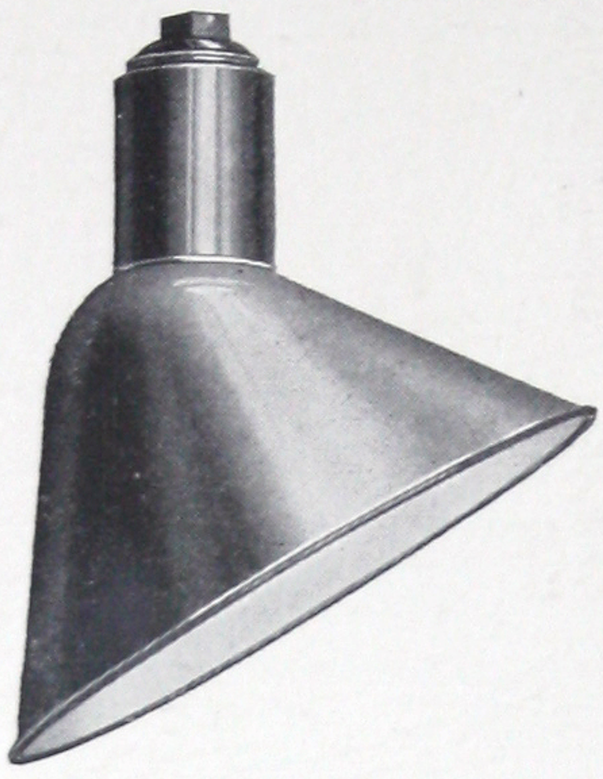

Fig. 5—Typical Porcelain-Enameled Steel Angle Reflector for Signs of Standard Size

Standard bulletin boards vary in height from 9 to 12 feet, the most modern practice being to have a plane surface of about 11 feet with a 6-inch molding at the top and bottom. There are numerous boards in which the spaces are divided into sections by moldings, and double-deck boards of both this and the ordinary type are common. With these boards, each section should be treated as a separate board and illuminated individually. For the lighting of boards of standard size, the most practical unit is the 200-watt MAZDA lamp with the proper size of porcelain-enameled steel angle reflector, such as that shown in Fig. 5. The reflector for the 200-watt lamp is the same size as that for the 100-watt lamp, and the 200-watt lamp may often be substituted for the 100 when a considerable increase of light is desired. The light distribution obtained with the 200-watt unit is shown by the curve given in Fig. 6. This curve shows that an intensity of 900 candle-power is directed toward the bottom of the board, decreasing gradually to 400 candle-power in the direction of the top of the board. The units should be placed, if possible, 6 feet out from the board and slightly above the top of the space to be illuminated, as indicated in Table 1.

For boards on which only moderate intensity of illumination is desired, the 100-watt unit will give satisfactory illumination. The distribution of light obtained with this unit is shown in Fig. 7. The units should be placed about 5½ feet out from the board, 5 feet apart, and slightly above the level of the top of the space to be illuminated. If, at any time, it is desired to increase

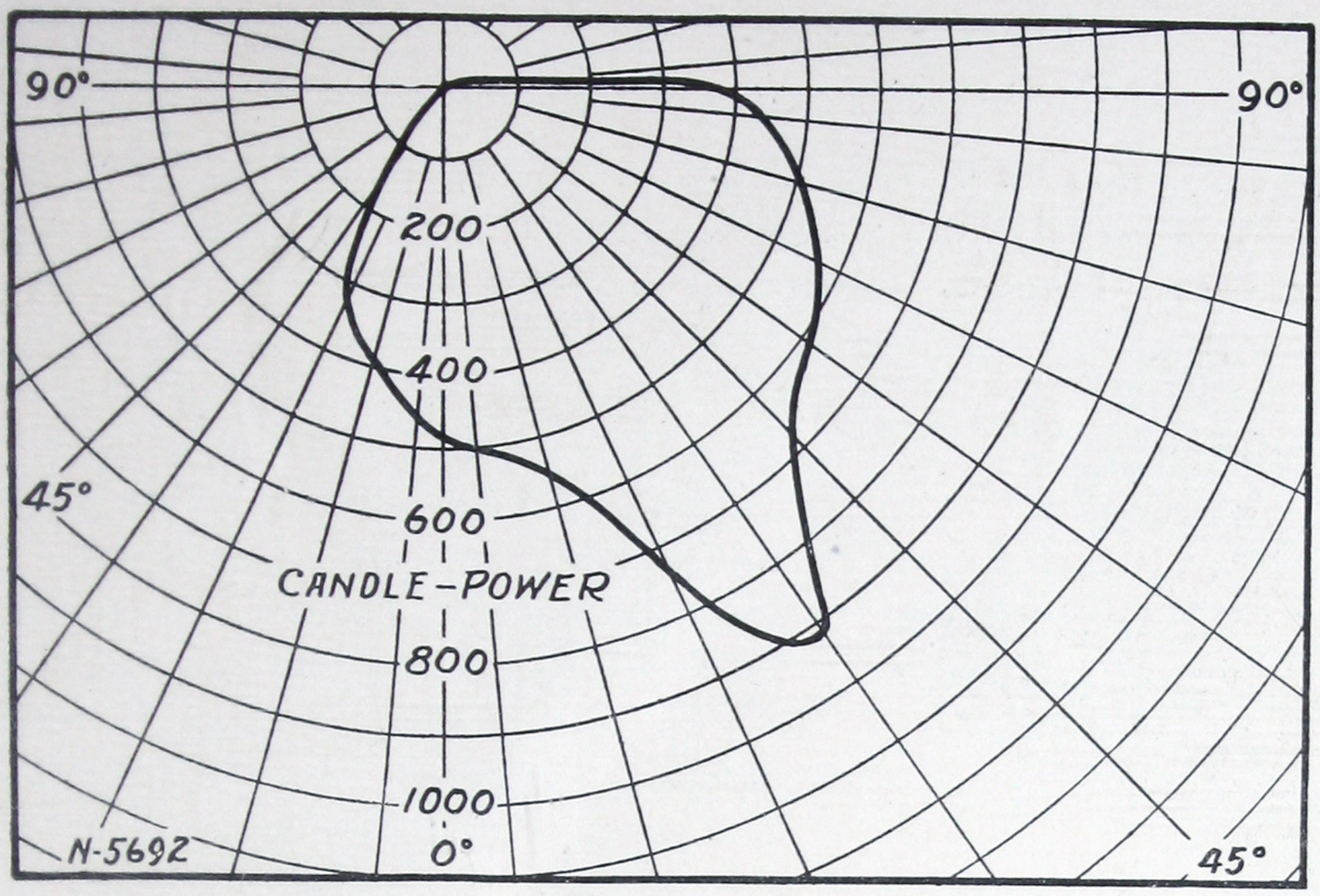

Fig. 6—Distribution Curve of 200-Watt MAZDA Lamp Equipped With Porcelain-Enameled Steel Angle Reflector

(Values Obtained at 0.80 W. P. C.)

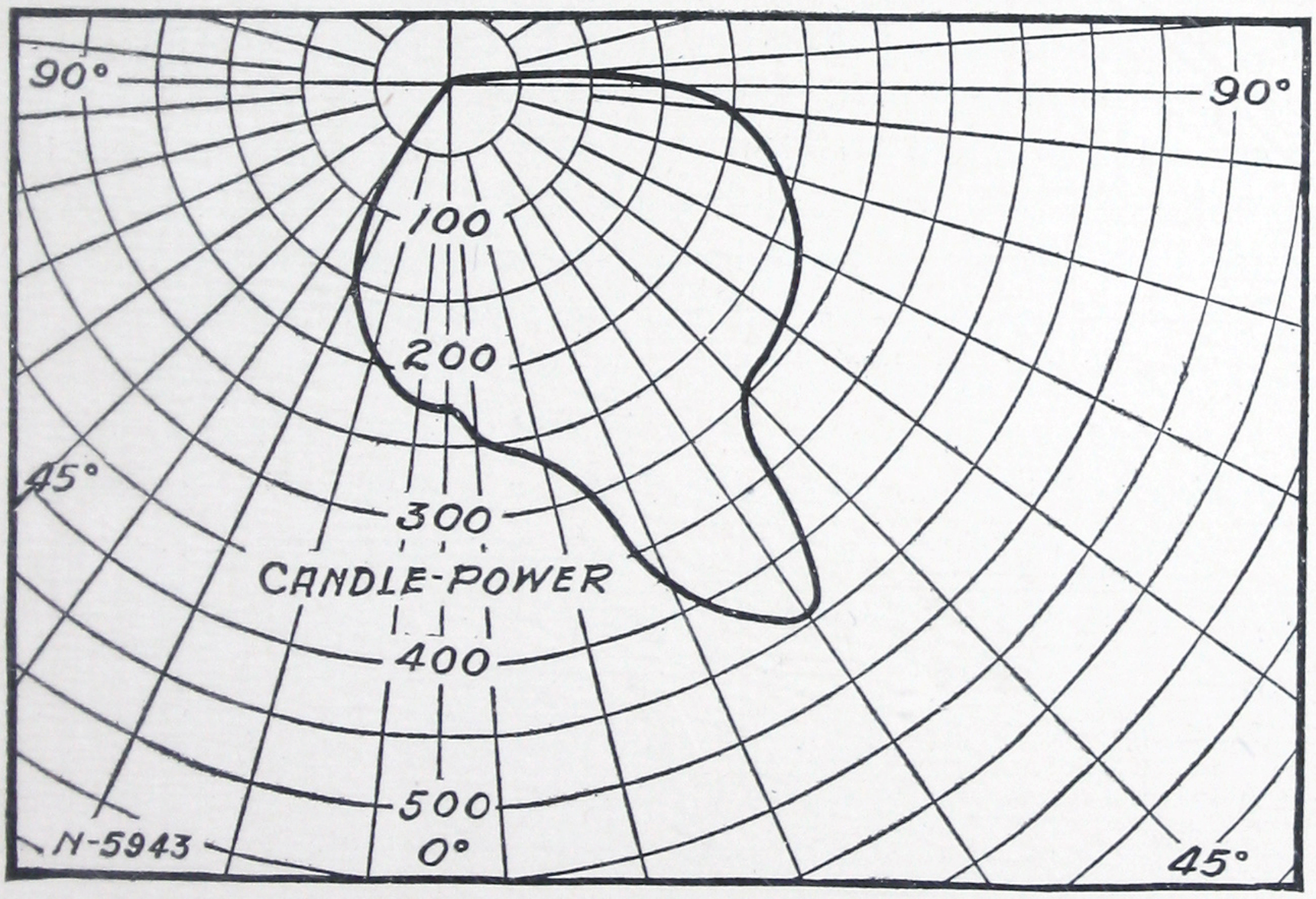

Fig. 7—Distribution Curve of 100-Watt MAZDA Lamp Equipped With Porcelain-Enameled Steel Angle Reflector

(Values Obtained at 0.80 W. P. C.)

the intensity of the illumination, the 200-watt MAZDA lamp can be substituted for the 100-watt lamp without change of reflector.

For signs more than 12 feet in height, the 300 to 1000 watt lamps in porcelain-enameled steel reflectors of the type shown in Fig. 8 give the same uniformity of illumination that has hitherto been obtained only with the best installations on standard-sized boards. The units, because of their small size, are simple to mount, and at the same time the high intensity and the excellent light distribution (see Fig. 9) make it possible to secure the necessary illumination with a small number of units. When the units are placed in front of the upper edge of the sign, it is necessary to place them well out from the sign, and mounting becomes complicated. However, because of the small number of units necessary, the installation cost is moderate considering the area illuminated; and, on account of the high efficiency of the units, the cost of operation is low. It is possible to avoid the complications involved in setting the units far out at the top by using two rows of smaller units, one row in front of the top edge of the sign and the other row in front of the sign and half-way between the top and bottom edges. Small units mounted in this manner are not conspicuous. Simplicity and economy of mounting, and easy accessibility for renewing lamps and cleaning reflectors should determine the method to be adopted.

Fig. 8—Typical Porcelain-Enameled Steel Angle Reflector for Signs Larger than Standard

In laying out an installation for billboard lighting, due consideration should be given to accessibility. The units should be so mounted that they may easily be reached regardless of weather conditions. The supports must be rugged enough to withstand the force of high winds which tend to whip them down against the face of the sign. Because of these considerations, there is a tendency to mount units too close to the sign, which is one of the chief causes of poor billboard illumination. Mounting the units far out from the sign is advantageous for two reasons; first, because it tends

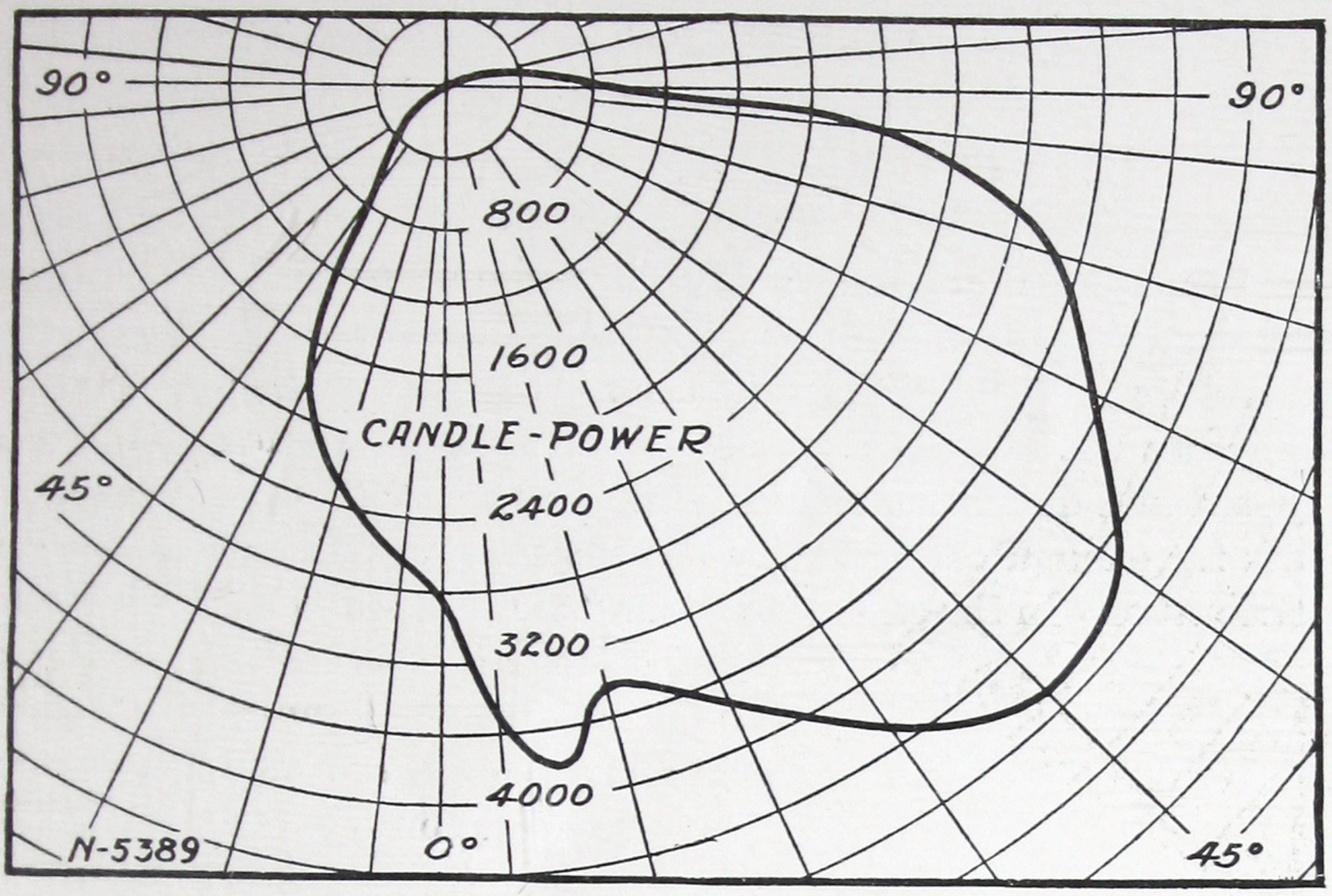

Fig. 9—Distribution Curve of 1000-Watt MAZDA Lamp Equipped With Porcelain-Enameled Steel Angle Reflector
(Values Obtained at 0.60 W. P. C.)

to equalize the distances from the reflector to the top of the board and from the reflector to the bottom of the board, and second, because it makes it possible to have the beam of light of highest intensity directed toward the base of the board, without tilting the reflector or causing shadows to form along the upper edge of the sign. Well designed reflectors confine the light to the board to such an extent that there is little waste of light when the units are set out at the proper distance.

Most of the reflectors for bulletin board lighting are tapped to take ½-inch pipe. The simplest method of installing the units consists of running ½-inch conduit up behind the board from a junction box fastened to the framework, bending the conduit forward at a right-angle at the top of the board, and fitting it with a ½-inch street-L to screw into the holder of the reflector. This method is illustrated by Fig. 10. It is necessary to run a steel guy wire from the street-L to the top of the board on each side. When the reflectors are mounted farther than about 6 feet out from the board, it is necessary to use a sturdier support. It is possible to use ½-inch conduit in the manner specified

for mounting reflectors as far as 10 feet out from the board, if, in addition to the side guy wires, a supporting guy is carried in from the unit to a support about 5 feet above the top of the board and four additional guys are attached to the conduit about half way out.

For convenience in cleaning the unit and renewing the lamps, it is necessary that the side guy wires be detachable, permitting the unit to be swung in against the top of the board. This method eliminates the necessity of using a ladder in front of the board in exposed and dangerous places, and makes it possible to mount the units far enough out from the sign to obtain proper uniformity of distribution. In the case of high signs where it is necessary to mount

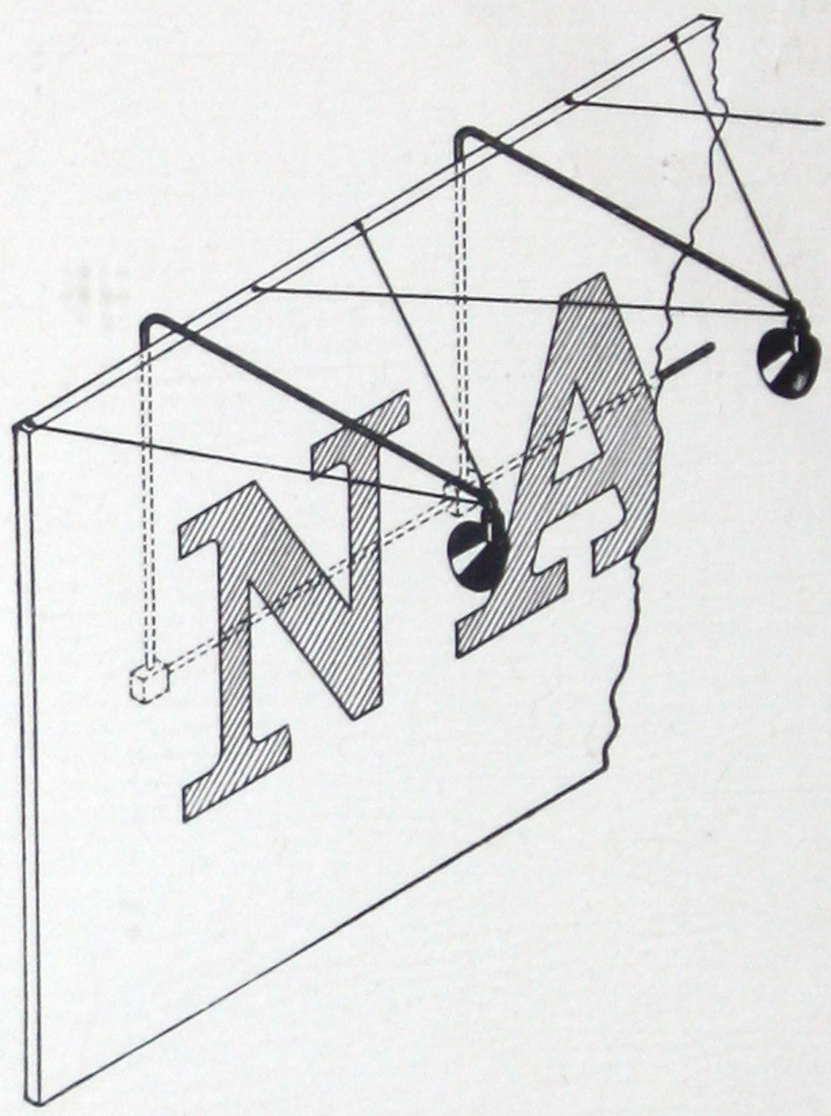

Fig. 10—Simple Method of Installing Units

high candle-power units 15 or more feet out from the sign, the methods of suspending units which are in common use in street-lighting are applicable. Heavy pipe, trussed and braced, can be used whenever a firm mounting above the sign can be secured. Another method of suspension consists of stretching a cable parallel to the sign at the proper distance out and supporting it either by trusses fastened to the building or by posts set in the ground. To facilitate cleaning and renewals, the units should be equipped with

Table No. 2

Data on MAZDA Lamps

Voltage	Watts	Efficiency, Watts Per Candle	Type and Size of Bulb	Diam. of Bulb, Inches	Maximum Over-All Length, Inches	Base Regularly Supplied	Standard Package Quantity
105-125	60	1.00	S-21	2⅜	5½	Med. Screw	100
	100	0.80	PS-25	3⅛	7⅛	Med. Screw	24
	200	.75	PS-30	3¾	8⅜	Med. Scr. Sk.	24
	300	0.70	PS-35	4⅜	9¾	Mog. Screw	24
	400	0.70	PS-40	5	10	Mog. Screw	12
	500	0.70	PS-40	5	10	Mog. Screw	12
	750	0.65	PS-52	6½	13⅜	Mog. Scr. Sk.	8
	1000	0.60	PS-52	6½	13⅜	Mog. Scr. Sk.	8

arc lamp hangers and cut-outs of the type in which the reflector always faces the sign when the cut-out locks, to permit lowering them to the ground. The same methods may be used when a row of reflectors is mounted half way between the top and bottom edges of the sign, but the supports need not be so rugged, and the whole arrangement becomes much simpler. When the situation is such that the units can be reached from the ground, a roof, or convenient windows, the cut-out hangers can be dispensed with and simple conduit supports may be used.

The essential technical data, in effect at the date of publication, on the lamps referred to in Table 1 are given in Table 2.

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OF THE

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OF GENERAL ELECTRIC CO.

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Brilliant Electric Division	Cleveland, Ohio
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Colonial Electric Division	Warren, Ohio
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The Fostoria Incandescent Lamp Division	Fostoria, Ohio
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